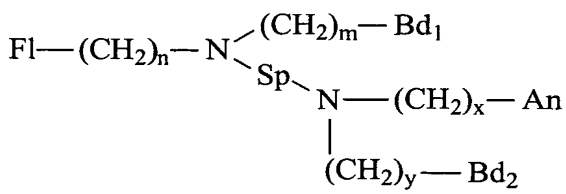
09,729,332

What is Claimed is:

1. A modular fluorescence sensor having the following general formula:



wherein:

Fl is a fluorophore;

N is a nitrogen atom;

B_{d1} and B_{d2} are independently selected binding groups, wherein the binding groups are capable of binding an analyte molecule to form a stable 1:1 complex;

Sp is an aliphatic spacer;

An is an anchor group for attaching the sensor to a solid substrate; and

n, m, x and y are integers, where y = 1 or 2;

n = 1 or 2, m = 1 or 2, and x is an integer.

2. The sensor of claim 1, wherein Fl is selected from the group consisting of naphtyl, anthryl, pyrenyl, phenanthryl, and perylenyl.

3. The sensor of claim 1, wherein B_{d1} is R_1-$B(OH)_2$ and B_{d2} is R_2-$B(OH)_2$, wherein R_1 and R_2 are aliphatic or aromatic functional groups selected independently from each other and B is a boron atom.

4. The sensor of claim 3, wherein R_1 and R_2 selected from the group consisting of: methyl, ethyl, propyl, butyl, phenyl, methoxy, ethoxy, butoxy, and phenoxy groups.

5. The sensor of claim 1, wherein Sp is a straight-chain alkane.

6. The sensor of claim 5, wherein the straight-chain alkane comprises from 1 to 9 carbon atoms.

7. The sensor of claim 6, wherein the straight-chain alkane comprises 6 carbon atoms.

8. The sensor of claim 1, wherein *An* comprises organic functionality.

9. The sensor of claim 8, wherein *An* comprises methyl.

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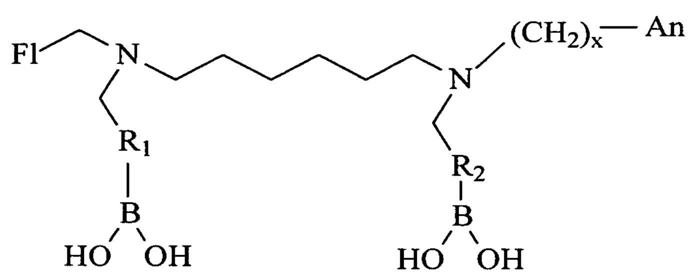
10. The sensor of claim 8, wherein *An* comprises phenyl.

11. The sensor of claim 1, wherein *An* and x are selected to provide stable attachment of the sensor to a micrometer scale particle.

12. The sensor of claim 11, wherein the particles are suitable for use in flow cytometry.

13. The sensor of claim 1, wherein B_{d1}, B_{d2}, Sp, m, and y are chosen to provide selective binding of the sensor to glucose.

14. A modular fluorescence sensor having the following general formula:



wherein:

Fl is a fluorophore;

N is a nitrogen atom and B is a boron atom;

R_1 and R_2 are aliphatic or aromatic functional groups which allow covalent binding of an analyte to the hydroxyl groups forming a stable 1:1 complex, wherein R_1 and R_2 are selected independently from each other and;

An is an anchor group for attaching the sensor to a solid substrate; and

x is an integer.

15. The sensor of claim 14, wherein Fl is selected from the group consisting of naphtyl, anthryl, pyrenyl, phenanthryl, and perylenyl.

16. The sensor of claim 14, wherein R_1 and R_2 are independently selected from the group consisting of: methyl, ethyl, propyl, butyl, phenyl, methoxy, ethoxy, butoxy, and phenoxy groups.

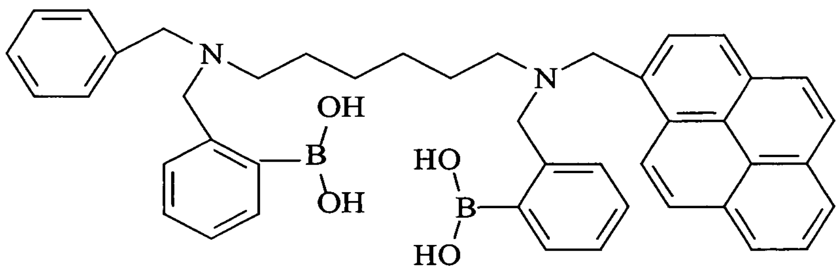
17. The sensor of claim 14, wherein *An* comprises organic functionality.

18. The sensor of claim 17, wherein *An* comprises methyl.

19. The sensor of claim 17, wherein *An* comprises phenyl.

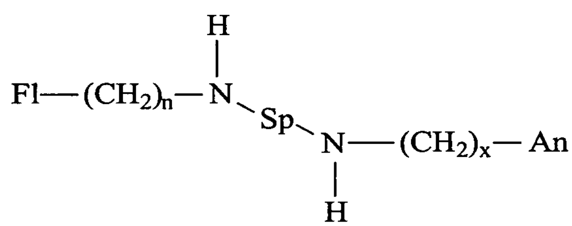
20. The sensor of claim 14, wherein *An* and x are selected to provide stable attachment of the sensor to a micrometer scale particle.

21. A modular fluorescence sensor of the following formula:



22. A method of synthesizing a modular fluorescence sensor comprising the steps of:

(a) forming an asymmetric compound of the following general formula:



wherein:

Fl is a fluorophore;

N is a nitrogen atom and H is a hydrogen atom;

Sp is an aliphatic spacer;

An is an anchor group for attaching the sensor to a solid substrate; and

n = 1 or 2, and x is any integer; and

(b) replacing hydrogen atoms with B_{d1} and B_{d2} groups, wherein B_{d1} and B_{d2} are independently selected binding groups capable of binding an analyte molecule to form a stable 1:1 complex.

23. The method of claim 22, wherein Fl is selected from the group consisting of naphtyl, anthryl, pyrenyl, phenanthryl, and perylenyl.

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24. The method of claim 22, wherein B_{d1} is R_1-$B(OH)_2$ and B_{d2} is R_2-$B(OH)_2$, wherein R_1 and R_2 are aliphatic or aromatic functional groups selected independently from each other, and B is a boron atom.

25. The method of claim 24, wherein R_1 and R_2 selected from the group consisting of: methyl, ethyl, propyl, butyl, phenyl, methoxy, ethoxy, butoxy, and phenoxy groups.

26. The method of claim 24, wherein the step of replacing of hydrogen atoms comprises adding orthobromomethyl phenylboronic acid.

27. The method of claim 22, wherein Sp is a straight-chain alkane.

28. The method of claim 27, wherein the straight-chain alkane comprises 9 carbon atoms.

29. The method of claim 28, wherein the straight-chain alkane comprises 6 carbon atoms.

30. The method of claim 22, wherein *An* comprises an organic functionality.

31. The method of claim 22, wherein *An* comprises methyl.

32. The method of claim 22, wherein *An* comprises phenyl.

33. A method of labeling solid substrates, comprising:

(a) providing a solid substrate;

(b) providing the modular fluorescence sensor of claim 1, wherein *An* is capable of being attached to the solid substrate;

(c) reacting the sensor with the solid substrate under a condition sufficient to attach the sensor to the substrate.

34. The method of claim 33, wherein the solid substrate is a micro particle.

35. The method of claim 34, wherein the diameter of the particle is from 0.1 to 20 micrometers.

36. The method of claim 34, wherein the particle is a porous particle, and wherein the sensor is bound to the inside of the pores of the particle.

37. The method of claim 34, wherein the particle is a hydrophobic insoluble particle, and wherein the sensor is coupled to the surface of the particle.

38. The method of claim 34, wherein the particle is made from a material selected from a group consisting of polystyrene latex, plasticized polyvinyl chloride, glass, a semipermeable membrane, and a bio-resorbable polymer.

39. The method of claim 38, wherein the bio-resorbable polymer is selected from a group consisting of polyglycolic acid (PGA), poly-DL-lactide-co-glycolide (PLGA), starch, and gelatin.

Ins A3 > Add claims 40-60

What is Claimed is:

1. A modular fluorescence sensor having the following general formula:

$$\mathrm{Fl}-(\mathrm{CH_2})_n-\mathrm{N}\begin{cases}(\mathrm{CH_2})_m-\mathrm{Bd_1}\\ \mathrm{Sp}-\mathrm{N}(-(\mathrm{CH_2})_x-\mathrm{An})(-(\mathrm{CH_2})_y-\mathrm{Bd_2})\end{cases}$$

wherein:

Fl is a fluorophore;

N is a nitrogen atom;

B_{d1} and B_{d2} are independently selected binding groups, wherein the binding groups are capable of binding an analyte molecule to form a stable 1:1 complex;

Sp is an aliphatic spacer;

An is an anchor group for attaching the sensor to a solid substrate; and

n = 1 or 2, m = 1 or 2, and x is an integer.

2. The sensor of claim 1, wherein Fl is selected from the group consisting of naphtyl, anthryl, pyrenyl, phenanthryl, and perylenyl.

3. The sensor of claim 1, wherein B_{d1} is R_1-$B(OH)_2$ and B_{d2} is R_2-$B(OH)_2$, wherein R_1 and R_2 are aliphatic or aromatic functional groups selected independently from each other and B is a boron atom.

4. The sensor of claim 3, wherein R_1 and R_2 selected from the group consisting of: methyl, ethyl, propyl, butyl, phenyl, methoxy, ethoxy, butoxy, and phenoxy groups.

5. The sensor of claim 1, wherein Sp is a straight-chain alkane.

6. The sensor of claim 5, wherein the straight-chain alkane comprises from 1 to 9 carbon atoms.

7. The sensor of claim 6, wherein the straight-chain alkane comprises 6 carbon atoms.

8. The sensor of claim 1, wherein *An* comprises organic functionality.

9. The sensor of claim 8, wherein *An* comprises methyl.

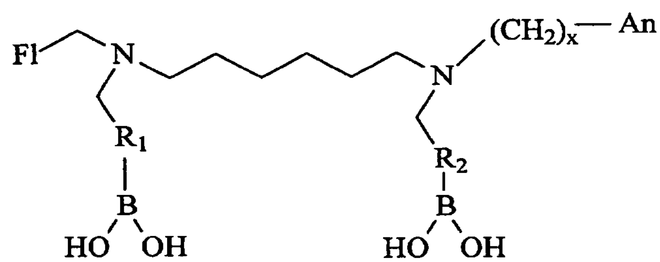
10. The sensor of claim 8, wherein *An* comprises phenyl.

11. The sensor of claim 1, wherein *An* and x are selected to provide stable attachment of the sensor to a micrometer scale particle.

12. The sensor of claim 11, wherein the particles are suitable for use in flow cytometry.

13. The sensor of claim 1, wherein B_{d1}, B_{d2}, Sp, m, and y are chosen to provide selective binding of the sensor to glucose.

14. A modular fluorescence sensor having the following general formula:



wherein:

Fl is a fluorophore;

N is a nitrogen atom and B is a boron atom;

R_1 and R_2 are aliphatic or aromatic functional groups which allow covalent binding of an analyte to the hydroxyl groups forming a stable 1:1 complex, wherein R_1 and R_2 are selected independently from each other and;

An is an anchor group for attaching the sensor to a solid substrate; and

x is an integer.

15. The sensor of claim 14, wherein Fl is selected from the group consisting of naphtyl, anthryl, pyrenyl, phenanthryl, and perylenyl.

16. The sensor of claim 14, wherein R_1 and R_2 are independently selected from the group consisting of: methyl, ethyl, propyl, butyl, phenyl, methoxy, ethoxy, butoxy, and phenoxy groups.

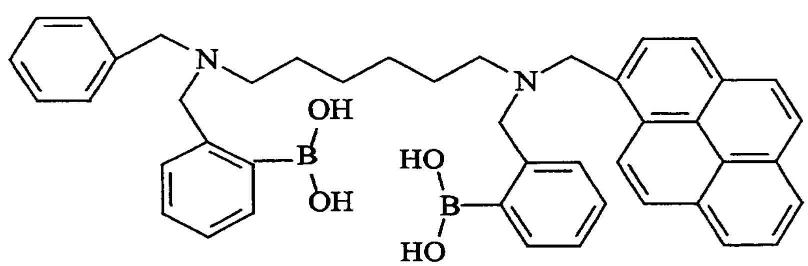
17. The sensor of claim 14, wherein *An* comprises organic functionality.

18. The sensor of claim 17, wherein *An* comprises methyl.

19. The sensor of claim 17, wherein *An* comprises phenyl.

20. The sensor of claim 14, wherein *An* and x are selected to provide stable attachment of the sensor to a micrometer scale particle.

21. A modular fluorescence sensor of the following formula:



22. A method of synthesizing a modular fluorescence sensor comprising the steps of:

(a) forming an asymmetric compound of the following general formula:

$$\mathrm{Fl{-}(CH_2)_n{-}\underset{}{\overset{H}{\overset{|}{N}}}{-}Sp{-}\underset{\underset{H}{|}}{N}{-}(CH_2)_x{-}An}$$

wherein:

Fl is a fluorophore;

N is a nitrogen atom and H is a hydrogen atom;

Sp is an aliphatic spacer;

An is an anchor group for attaching the sensor to a solid substrate; and

n = 1 or 2, and x is any integer; and

(b) replacing hydrogen atoms with B_{d1} and B_{d2} groups, wherein B_{d1} and B_{d2} are independently selected binding groups capable of binding an analyte molecule to form a stable 1:1 complex.

23. The method of claim 22, wherein Fl is selected from the group consisting of naphtyl, anthryl, pyrenyl, phenanthryl, and perylenyl.

24. The method of claim 22, wherein B_{d1} is R_1-$B(OH)_2$ and B_{d2} is R_2-$B(OH)_2$, wherein R_1 and R_2 are aliphatic or aromatic functional groups selected independently from each other, and B is a boron atom.

25. The method of claim 24, wherein R_1 and R_2 selected from the group consisting of: methyl, ethyl, propyl, butyl, phenyl, methoxy, ethoxy, butoxy, and phenoxy groups.

26. The method of claim 24, wherein the step of replacing of hydrogen atoms comprises adding orthobromomethyl phenylboronic acid.

27. The method of claim 22, wherein Sp is a straight-chain alkane.

28. The method of claim 27, wherein the straight-chain alkane comprises 9 carbon atoms.

29. The method of claim 28, wherein the straight-chain alkane comprises 6 carbon atoms.

30. The method of claim 22, wherein *An* comprises an organic functionality.

31. The method of claim 22, wherein *An* comprises methyl.

32. The method of claim 22, wherein *An* comprises phenyl.

33. A method of labeling solid substrates, comprising:

(a) providing a solid substrate;

(b) providing the modular fluorescence sensor of claim 1, wherein *An* is capable of being attached to the solid substrate;

(c) reacting the sensor with the solid substrate under a condition sufficient to attach the sensor to the substrate.

34. The method of claim 33, wherein the solid substrate is a micro particle.

35. The method of claim 34, wherein the diameter of the particle is from 0.1 to 20 micrometers.

36. The method of claim 34, wherein the particle is a porous particle, and wherein the sensor is bound to the inside of the pores of the particle.

37. The method of claim 34, wherein the particle is a hydrophobic insoluble particle, and wherein the sensor is coupled to the surface of the particle.

38. The method of claim 34, wherein the particle is made from a material selected from a group consisting of polystyrene latex, plasticized polyvinyl chloride, glass, a semipermeable membrane, and a bio-resorbable polymer.

39. The method of claim 38, wherein the bio-resorbable polymer is selected from a group consisting of polyglycolic acid (PGA), poly-DL-lactide-co-glycolide (PLGA), starch, and gelatin.